

Strong R&D partnerships energize the buildings of the 21st century

THE BENEFITS

BTS R&D efforts lead to:

- Reduced energy use and greenhouse gas emissions
- Improved occupant comfort and productivity
- Economic growth for local communities
- Strong, effective partnerships with industry and States
- Global leadership in advanced energy technologies

A Comprehensive R&D Agenda

Uncomfortable, poorly lit workplaces. Cold, inadequately insulated homes. Energy-hogging appliances. Windows and ducts that leak air. Landfills heaped with construction wastes. To address these and many other issues, the U.S. Department of Energy's Office of Building Technology, State and Community Programs (BTS) is pursuing a comprehensive research and development (R&D) agenda.

BTS research is conducted with partners in all areas of the U.S. building industry, along with academia, State governments, community organizations, and National Laboratories. BTS and its partners are working to reduce the more than \$200 billion spent each year to heat, cool, light, and operate equipment in U.S. homes and commercial buildings. These efforts will significantly reduce the energy used in our Nation's buildings, estimated in 1995 to be more than one-third of all the energy consumed in the United States.

Such inefficient use of energy contributes significantly to air pollution. In fact, buildings accounted for 35 percent of U.S. carbon emissions, 47 percent of sulfur dioxide emissions, and 22 percent of nitrogen oxide emissions in 1995. Without new energy-efficient technologies, and with the anticipated 18.4 million new homes and 21.5 billion square feet of commercial floor space being constructed between now and 2010, building energy consumption and emissions will literally "go through the roof" and "out the window."

R&D support from BTS enabled Fusion Lighting of Rockville, Maryland, to develop and market the sulfur lamps that illuminate this display at the National Air and Space Museum in Washington, D.C. The lamps cut energy lighting and maintenance costs by 50 percent while increasing the quality and quantity of light.



ON THE MARKET TODAY

Several energy-efficient products and processes on the market today are outgrowths of BTS technology research:

- Electronic lighting ballasts
- Low-E windows
- Advanced oil burners
- High-efficiency refrigerator/freezers
- Composite wall systems
- Building design models
- Energy audit standards

Yesterday's Achievements

In the last decade, BTS-funded research helped sharpen the U.S. competitive edge in several key building industries. The General Accounting Office estimated over \$28 billion in consumer savings from BTS technologies. BTS' cost-effective efficiency advances in lighting, windows, insulation, building materials, appliances, weatherization, and whole-building design are being put to the test by architects, builders, and building managers across the Nation. Here are just a few examples:

- Prototype technology such as the high-efficiency sulfur lamp developed by industry in conjunction with BTS researchers is proving its mettle in several Washington, D.C., locations. Two of them are the National Air and Space Museum and the Forrestal Building, home of the U.S. Department of Energy (DOE). The Forrestal system has shown measured energy savings of more than 65 percent and saved DOE approximately \$8,000 in energy costs plus an additional \$1,500 in maintenance costs. These prototypes are also creating an international market for U.S. technology in Sweden, Japan, and Canada.
- Home builders across the Nation are incorporating BTS research technologies into thousands of new and retrofitted homes. More than 300 homes in the Prairie Crossing development in Grayslake, Illinois, are being constructed of environmentally sensitive materials and have increased ceiling, wall, and foundation insulation; double-glazed, gas-filled, low-E windows; continuous air barriers; and controlled building ventilation. The homes use 48 percent less energy than standard Illinois homes. For the buyer, the up-front costs for these energy-efficient houses are equal to or only slightly higher than conventional construction.
- Building engineers and architects from across the Nation and around the world are using BTS-developed design tools to increase the energy efficiency and lower the environmental impact of new and retrofitted construction. Computerized modeling tools such as *Designing Low Energy Buildings/ENERGY-10* and *DOE-2* help designers integrate energy-efficient and renewable-energy components and systems into building plans at the blueprint stage. Data on every aspect of a building's site (climate, shading, orientation), materials (wood, brick, insulation, windows), and equipment (chillers, lighting, computers) go into calculations to optimize building performance and occupant comfort and productivity.



From the outside, Prairie Crossing houses don't look any different from other houses in the Grayslake, Illinois, area. Yet these Building America homes use about half the energy of nearby homes.

BTS researchers at the DOE's Oak Ridge National Laboratory, in partnership with the Association of Home Appliance Manufacturers, have developed a 20-cubic-foot refrigerator-freezer that uses only 1.04 kilowatt-hour of electricity per day, half the current standard.



The BTS

R&D portfolio has been defined in collaboration with industry stakeholders and customers.

Today's Portfolio

Today, BTS' R&D portfolio concentrates on two areas: building components and building systems integration. R&D on individual building components — building envelope elements, equipment, and appliances — provides the technical basis for significant energy savings in buildings. Systems integration R&D — which takes into account the interactions of individual components, materials, and equipment systems within the building — provides the basis for whole-building design so the overall building performance of new construction is greater than the sum of its parts.

New, advanced component technologies are often twice as efficient as conventional components and still meet the challenging reliability and cost requirements for new building construction. New component technologies also represent one of the best opportunities for increasing energy efficiency through retrofits in existing buildings. More than 90 percent of the current U.S. building inventory will still be standing in 2020. As our buildings age over the next several decades, energy-efficient and renewable energy retrofits will dominate energy issues in the building sector.

The integrated systems, whole-building approach can result in higher performance throughout a building's life cycle — from site selection and financing through design, construction, commissioning, operation and maintenance, renovation, demolition, and replacement. The BTS portfolio has been defined in collaboration with industry stakeholders and customers and includes R&D that encompasses all aspects of a building's life cycle.

THE BTS R&D PORTFOLIO

Building Components

Heating, Ventilating,
and Air-Conditioning Equipment
Lighting and Appliances
Building Envelope Technologies

Building Systems Integration

Residential Buildings
Commercial Buildings



BUILDINGS FOR THE 21ST CENTURY

Buildings that are more energy-efficient, comfortable, and affordable . . . that's the goal of DOE's Office of Building Technology, State and Community Programs (BTS). To accelerate the development and wide application of energy efficiency measures, BTS:

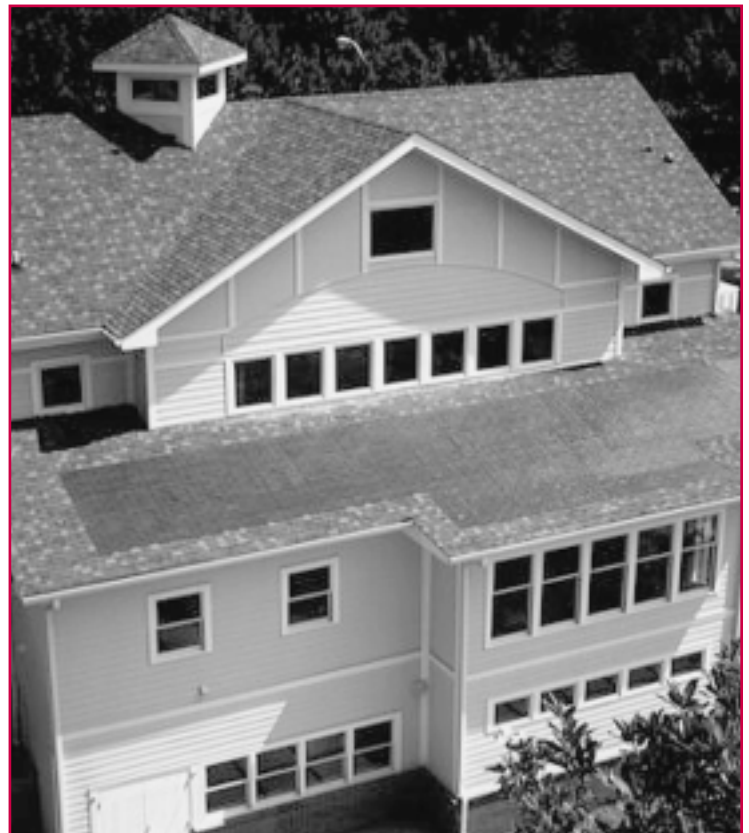
- Conducts R&D on technologies and concepts for energy efficiency, working closely with the building industry and with manufacturers of materials, equipment, and appliances
- Promotes energy/money saving opportunities to both builders and buyers of homes and commercial buildings
- Works with State and local regulatory groups to improve building codes, appliance standards, and guidelines for efficient energy use
- Provides support and grants to States and communities for deployment of energy-efficient technologies and practices

Tomorrow's Vision

BTS will continue the collaborative process with industry on these priorities by charting technology roadmaps in several major building industry areas — lighting, heating and cooling, windows, insulation, and systems integration in both commercial and residential buildings.

BTS will conduct several executive forums with leaders from all building industry sectors to forge the vision for each technology roadmap. Technical practitioners will gather in BTS workshops to plot the R&D roadmaps to help industry reach its vision. Using these roadmaps, BTS and its research partners will develop and implement new, energy-efficient and renewable energy technologies to realize the BTS goals of reducing energy use in residential buildings by 50 percent and in commercial buildings by 20 percent through the next two decades. In addition, BTS will utilize greater peer review to ensure its science is sound.

The Southface Energy & Environmental Resource Center in Atlanta, Georgia, is a showcase for cutting-edge energy efficiency and renewable energy technologies for the building sector. The Center is used to educate students, teachers, architects, design engineers, and builders about the installation, cost savings, environmental benefits, and overall desirability of using advanced energy technologies in buildings.



FOR MORE INFORMATION, CONTACT:

Office of Building Technology, State and Community Programs • U.S. Department of Energy
1000 Independence Avenue, SW • Washington, DC 20585-0121 • (202)586-1510

Call the Energy Efficiency and Renewable Energy Clearinghouse at: 1-800-DOE-3732
Or visit the BTS Web site at: www.eren.doe.gov/buildings



Printed with a renewable-source ink on paper containing at least 50% wastepaper, including 20% postconsumer waste.

January 1999 DOE/GO-10099-704